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Evidence for a Supernova of A.D. 1006

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It is the purpose of this paper to present evidence concerning an extraordinary astronomical event of A.D. 1006 and to indicate the reasons for believing that it was the appearance of a supernova in the constellation Lupus, in the vicinity of, if not identical with, NGC 5882. That several reports mention scintillation, and that one report indicates the lack of proper motion, would seem to preclude the possibility of a comet.

The coordinates ot NGC 5882 are as follows:

	epoch 1006	epoch 1950
right ascension	$14^{\mathrm{h}}12^{\mathrm{m}}.2$	$15^{\mathrm{h}}13^{\mathrm{m}}.4$
declination	$-41°28'$	$-45°28'$
longitude	$225°30'$	
latitude	$-26°21'$	

These coordinates satisfy all of the records (to an accuracy of, say, 3°), known to me at present, concerning the location of this supernova. The supernova, at the time of its appearance, is said by one source (ʿAlī b. Riḍwān) to have been as bright as the moon one-quarter illuminated. This brightness estimate may be discredited by a prior remark to the effect that the size of the supernova, i.e., its apparent diameter, was $2\frac{1}{2}$ to 3 times that of Venus. Venus, though a point source to the naked eye, nevertheless appears to have a finite diameter (due to an optical effect whose cause is partly physiological) estimated by the ancients as $\frac{1}{10}$ the apparent diameter of the sun, which is the same as $\frac{1}{10}$ the apparent diameter of the moon. One may see a numerical agreement between $2\frac{1}{2}$ to 3 times the size of Venus ($2\frac{1}{2}$ times $\frac{1}{10}$) and a quarter of the diameter of the moon. Another text would seem to indicate that this supernova cast shadows, as does the moon, while in size and brightness it was similar to (i.e., comparable to, but not necessarily equal to) Venus. The minimum brightness capable of producing a shadow may be taken as a reasonable lower bound. Though not explicitly mentioned in any of the sources, it would seem that the brightness remained essentially constant from the time of appearance, about 1 May 1006, until shortly before disappearance, about 13 August 1006. The sources I have consulted represent observations in Morocco (perhaps Spain), Europe, Egypt, Iraq, and the Far East.

We first examine the most extensive description of this event, by ʿAlī b. Riḍwān (d. 1061) who lived in Fusṭaṭ (the old city of Cairo) in Egypt. After this discussion, the other records of this event are presented and discussed. Appendix II contains in copy the Arabic texts which I have translated in the body of this paper.

1. THE OBSERVATION OF ʿALĪ B. RIḌWĀN

The observation of an unusual astronomical event is recorded by ʿAlī b. Riḍwān in his commentary to an astrological treatise, *The Tetrabiblos* (Latin: *Quadripartitum*), of Ptolemy. The translation, which follows, is based on the Arabic text of ʿAlī b. Riḍwān's commentary to book 2, chapter 9, of *The Tetrabiblos* [the relevant passage is taken from ms Escurial (Casiri), 908, fol. 24ᵛ–25ʳ corresponding to ms Escurial 911, 1, fol. 64ʳ. Ms Escurial 908 was copies 3 Rabiʿ I, 745 A.H. in Cardova, and is partly written in Hebrew characters. A transcription of the Arabic text appears in Appendix II, text 1. The Latin translation of this passage may be found in Aegidius Tebaldinus, *Quadripartitum* (Venice 1493), fol. 47ʳ. References to variant readings in the Latin text refer to this publication]:

> I will now describe for you a spectacle (*athar*) that I saw at the beginning of my education (*taʿalīm*). This spectacle (*athar*) appeared in the zodiacal sign Scorpio in opposition to the sun, at which time the sun was in the 15th degree of Taurus, and the spectacle (*nayzak*) in the 15th degree of Scorpio. It was a large *nayzak*, round in shape, and its size $2\frac{1}{2}$ or 3 times the magnitude of Venus. Its light illuminated the horizon and it twinkled very much. The magnitude of its brightness was a little more than a quarter of the brightness of the moon. It continued to appear and it moved in that zodiacal sign with the motion of the equator (i.e., the daily rotation) until the sun arrived at the zodiacal sign Virgo, in sextile to it [an astrological term meaning that the sun was within two zodiacal signs of the apparition], and it ceased (appearing) all of a sudden (*dufʿatan wāḥidatan*). This apparition was also observed at the time by (other) scholars just as I have recorded it. The positions of the planets when it began to appear were as follows:

Sun and moon:	Taurus	15°
Saturn:	Leo	12;11
Jupiter:	Cancer	11;21
Mars	Scorpio	21;19
[Latin reads: Scorpio 21;9° (21;9° means 21 degrees and 9 minutes]		
Venus	Gemini	12;28
Mercury	Taurus	5;11
[Latin reads: Taurus 5;5°]		
Lunar (ascending) node:	Sagittarius	23;28

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> The *nayzak* came forth in the 15th degree of Scorpio. The ascendant of the conjunction at the time of the appearance of the *nayzak*, for the horizon of Fusṭaṭ in Egypt, was 4;2° of Leo; and the tenth (house which included most of) Taurus began at Aries 26;27°. [Latin reads: Aries 27;27°. The ascendant is the point of the ecliptic which is rising from the horizon at some given time. The tenth house begins at the upper culmination of the ecliptic and is a portion of the ecliptic which rises in two hours. There are twelve houses in all, starting from the ascendant in the order of the zodiacal signs.]
>
> Scorpio is the sign which indicates calamity (*kusūf*) for the Muslim community. Therefore, great wars have broken out between Muslims which have destroyed great countries. Thus the *Khawārij* [a heretical Muslim sect. The reference is to the civil war in Arabia at the time of the Omayyads] went out against the king of the two holy cities (Mecca and Medina) [Latin: mecche et yetob (i.e., yathrib, or Medina)]. Famine, dearth, and pestilence broke out, and many thousands beyond count died by the sword, as well as from dearth and pestilence. At the time when the *nayzak* appeared, there (again) occurred calamity and destruction which lasted for many years after its appearance; and we examine this for (its) exemplariness.

This is certainly a crucial passage for determining the nature of the observation in that it is the report of an observer himself and contains much astronomical information. Firstly the date of the observation can be fixed without any doubt from the list of planetary positions for the time of the appearance of this celestial phenomenon.

Table I presents a comparison of the longitudes of the planets as given by ʻAlī b. Riḍwān with modern recomputations of the planetary positions for 1 May 1006, 7 p.m. Babylon (Tuckerman 1964).

From the position of the moon on 1 May we can see that ʻAlī b. Riḍwān meant the previous day, 30 April 1006, for which date one finds excellent agreement between his data and the modern computation of the planetary positions. The data of ʻAlī b. Riḍwān were, of course, computed by him as one can see, for example, from the fact that the moon was invisible at the time.

TABLE I. Comparison of longitudes of the planets.

	ʻAlī b. Riḍwān	Modern (1 May 1006)
Sun	45°	46°
Moon	45	62
Mercury	35	37
Venus	72	74
Mars	231	228
Jupiter	101	101
Saturn	132	132
Ascending node	263	263[a]

[a] Computed from Neugebauer 1914.

I have translated the words used to describe the celestial body in question as "spectacle" so as not to prejudge the matter. The first word, *athar*, is a common Arabic word meaning *mark* or *trace*. The The second word, *nayzak*, is much rarer and I know of only two other places where it occurs. One such reference was noted by Kennedy (1957), and the complete context (p. 44) is as follows:

> A Christian astrologer of Baghdad, [Ibn Hibintā] in 829 wrote an astrological work entitled *Al-Mughnī*, a copy of the second part of which (Cod. arab. 852) is in the Bayerische Staatsbibliotek in Munich. On folio 67 vs. of this document there begins a section entitled 'On the stars Having Tails.' The passage states that there are seven such stars in the heaven (or sphere) of the sun, surrounding it after the fashion of stars. The manuscript names five of these:
>
> *Ṭaifur*, an Arabic given name (cf. the comet named Typhon, Bouché-Leclercq, *L'astrologie grecque*, Paris, 1899, p. 359).
>
> *Nayzak*, a Persian loan work in Arabic meaning a short spear, hence 'a meteor.'
>
> *Al-ʻAṣa*, meaning 'the stick.'
>
> *Dhū al-Laḥya*, 'the bearded one.'
>
> *Dhū al-Qaṣaʻa*, 'the hunchback.'
>
> If God permits some event to transpire in a certain locality, says Ibn Hibintā, He displays one of these stars as a sign. Their indications were explained by the ancients.
>
> There follows a series of confused remarks as to where comets may be expected to appear. Most of the conditions involve proximity to the planet Mercury, which, since Mercury never elongates far from the sun, is consistent with the opening sentence of the section.

This concludes the entire relevant passage from Kennedy's article. In this context *nayzak* seems to be the name of a mythical comet near the sun; but our celestial body was first seen in opposition to the sun. The second occurrence of *nayzak* known to me is in an Arabic chronicle also describing the appearance of the supernova with which we are concerned (see below) and does not add any astronomical information about this term. The Latin version (Aegidius Tebaldinus, fol. 47^{r}) translates *nayzak* as "*stella ipsa alāzadera*," where *alāzadera* is undoubtedly a corruption of *al-nayzak*. Cardanus (1555, p. 353) substitutes the word "comet" in his paraphrase of this passage from ʻAlī b. Riḍwān, and this has had a strong influence on the later literature, as shown below.

ʻAlī's opening remark, that he had observed this event at the beginning of his education, agrees with the dating I have adopted, which makes it 55 years before his death. The location of the celestial object in the sky is given as the 15th degree of

Scorpio (i.e., its longitude for that epoch was 225°). This longitude is quite close to that of NGC 5882 (225;30°) for the same epoch. Its latitude is not mentioned. Its size is described as $2\frac{1}{2}$ to 3 times that of Venus. In the context of medieval astronomy, *size* is a measure of the planet's apparent diameter (to the naked eye), and the apparent diameter of Venus is generally given as $\frac{1}{10}$ that of the sun (cf. Dreyer 1953, p. 258), which is the same as $\frac{1}{10}$ the apparent diameter of the moon, or about 3 min of arc. I then understand the passage to mean that this very bright object appeared to have a diameter of 8 or 9 min, which is about a quarter of the diameter of the moon. Then its brightness is given as a quarter the brightness of the moon. (Cf. Cardanus, p. 353: *Lux eius, quantum si quarta pars Lunae luceret.*) If this statement is independent of the comparison with Venus, one reading of the text is that its brightness was a quarter of the brightness of the full moon, and indeed the moon was full when it came near to the celestial body in the 15th degree of Scorpio. Another possible interpretation is that it was as bright as the moon when a little more than a quarter of its surface is illuminated, and this latter interpretation is consistent with the comparison to the size of Venus. The magnitude of the moon quarter illuminated is −8 and at quadrature −10. These are certainly the upper limits on the magnitude of the supernova, and ensure that the supernova would illuminate the horizon, as the text indicates

The next sentence, concerning its motion, is crucial for distinguishing between a comet and a nova. The Arabic text unequivocally states that the unknown body had a fixed position while the sun moved from Taurus to Virgo, which would take approximately four months. Cardanus, however, in his paraphrase (p. 353) makes it seem that it was the unknown body that moved precipitously from Scorpio to Virgo, and this interpretation has given rise to a large literature on "the comet of 1006". [Cf. Pingré, *Cométographie* (1783), Vol. I, p. 363 ff.; Galle, *Cometenbahnen* (1894), p. 2, Nr. 16 (this reference is not to be found Galle's *Bestimmungsstücke der Bahn aller bisher berechneten Cometen* (Weimar 1847); and similarly cf. Catalog of Cometary Orbits (1961). All of the notices after Pingré depend on his understanding that 30 April 1006 ʿAlī b. Riḍwān observed a swift retrograde comet whose elements are analogous to those of Halley's Comet. The availability of the Arabic text now makes this interpretation of the observation no longer tenable, and this "comet" might well be striken from the roster.] The sudden disappearance of this celestial body cannot be accounted for by the proximity of the sun, but rather by the rapid diminution of its magnitude.

2. OTHER ISLAMIC AND WESTERN ACCOUNTS OF THE SUPERNOVA OF 1006

Schönfeld, in 1891, suggested the possibility of a nova for 1006 based on the Chronicles of Bar Hebraeus (13th century), Ibn al-Athīr (also 13th century, but earlier than Bar Hebraeus), and Hepidannus (d. 1083), a monk of St. Gall. [See Schönfeld 1891, cols. 153, 154. Lundmark (1921) refers to this notice of Schönfeld, and the passage in Hepidannus had already been noticed by Pingré (1783, Vol. I, p. 365), and by von Humbolt (1880, p. 212).]

Ibn al-Athīr wrote:

> In that year (A.H. 396), at the new moon of (the month) *Shuʿban*, a large star similar to Venus appeared to the left side of the *qibla* (i.e., the direction to Mecca) of Iraq. Its rays on the earth were like the rays of the moon, and it remained until the middle of (the month) *Dhū al-Qaʿda* when it disappeared.

[For the Arabic text, see Appendix II, text 2, taken from the 1863 Leyden edition of C. Tornberg (Vol. IX, p. 134) and agrees with the Bulak edition of 1874 (Vol. IX, p. 71).]

The source of the notice of Ibn al-Athīr is undoubtedly the account of Ibn al-Jawzī (d. 1200) in his book, *Kitāb al-Muntaẓam* [(1939), Vol. VII, p. 230. The Arabic text is reproduced in Appendix II, text 3]:

> Among the reports for (A.H. 396): There appeared a great star similar to Venus in size and brightness wavering to the left of the *qibla*. Its rays on the earth were like the rays of the moon. It appeared on the night (preceding) Friday, the new moon of *Shuʿban*, and it remained fixed until the middle of *Dhū al-Qaʿda*, whereupon it disappeared.

The most significant difference between the two texts is that the earlier one omits the word *al-ʿIraq*, and simply says "to the left of the *qibla*." The *qibla* is the direction to Mecca, i.e., a fixed point on the horizon which depends on geographical location. As this report does not fix the location of the observation with any precision, we can only conclude that this "guest star" set in the vicinity of the *qibla* somewhere in Iraq. If we identify the position of this "guest star" with NGC 5882, then the setting point of this star, as seen from the city of Basra in lower Mesopotamia, and the *qibla* of that city virtually coincided (i.e., about 39° from the south point on the horizon). Despite the comparison to both Venus and the moon as in the passage of ʿAlī b. Riḍwān, I take this notice to be based on an independent observation. The comparison of the object's rays to those of the moon

1965AJ.....70..105G

would indicate that it cast shadows. The dates for appearance and disappearance are clearly given. The new moon of Shuʿban, when it is said to have appeared, is to be identified with the first day of the lunar month of the Arabic calendar, i.e., 3 May 1006. It disappeared in the middle of Dhū al-Qaʿda, i.e., *ca.* 13 August 1006. The interval of $3\frac{1}{2}$ months agrees with the interpretation of the passage from ʿAlī b. Riḍwān (on 13 August 1006 the longitude of the sun was the 25th degree of Cancer, i.e., five degrees short of Virgo).

The notice of Bar Hebraeus adds no new information and would seem to be dependent on the Arabic sources which have already been cited. As translated from the original Syrac by Budge (Bar Hebraeus 1932), we read:

> A.H. 396: There appeared a star resembling Aphrodite in greatness and splendour in the zodiacal sign Scorpio, its rays revolved and gave out light like that of the moon—it remained four months and disappeared.

Another Arabic chronicle [*Annales Regum Mauritaniae* (a.d. A.H. 726) (see Tornberg 1843), Arabic text, Vol. I, p. 74; Latin translation and critical apparatus, Vol. I, p. 99. For the Arabic text, see Appendix II, text 4. Textual variants have been placed in parentheses and explanatory remarks in square brackets. An account similar to this one concerning the appearance of a great star in A.H. 396, but without any reference to its source, may be found in Conde (1840, p. 277).] gave this account:

> 1. In the Year 394 [A.H.] a brilliant star appeared in the sky. It was a great star giving off much light. (When it appeared on the eastern horizon, some of the astronomers said that this star was known as the expiration of a comet [possessor of a tail]. It was a great star appearing excessively bright, and very turbulent. It moved and had four strands bare of extremities.)
>
> 2. In the year 396 [A.H.] a great [variant: wondrous] star, a comet, appeared which was very brilliant [variant: most frightening], (whose unrest hindered attentive observations; yet its appearance was beyond doubt). It was one *nayzak* of the twelve [adding the word *ʿashar* to the Arabic text as does Tornberg], which the ancients mentioned. Their scholars observed it for a long time and they argued that a star could only appear as a judgment for the world, upon which God has resolved but God knows His secrets best. (It began to appear in the beginning of Shuʿban [3]96 [A.H.]. Its first appearance took place before (its) setting whereupon it went backwards until it rose (the following) night. It lasted for a period of six months and then disappeared. In that year there were strong winds, bursts of lightning, and shattering thunder, without rain.)

The first observation, for A.H. 394, refers to the appearance of a comet and is probably identical with the one noted by Ho Peng Yoke (1962) for 21 December 1003. Our main concern, however, is with the second observation, for A.H. 396. Here we find the celestial body called a comet and then a *nayzak*, exactly the same word used by ʿAlī b. Riḍwān. Lacking a systematic program of observation, it is not too surprising that this object is called a comet, and the name should not pose any great difficulty for us. The date for its appearance is familiar, namely, *ca.* 3 May 1006. The backward motion is to be understood as the daily rotation.

In the Latin Chronicles I have found two references to a bright star appearing in 1006, and two additional references ["A. 1006. Fames maxima fuit apparente longo tempore comete" (Annales Laubiensis 1841) "A. 1006. Eodem itaque tempore stella cometis, cuius indicium humanum semper pronunciat flagicium, in meridiano climate apparens, quam maxima per omnes Italiae seu Veneciae fines pestilentia subsecuta est" (Johannes Chronicon Venetum 1846, p. 36)] to a comet in 1006 which is probably identical to the bright star which appeared. Hepidannus, the monk of St. Gall whose annals extend to the year 1044, described a new star of unusual magnitude which appeared in the year 1006. It was seen for three months in the extreme south and seemed to vary in size contracting and expanding (i.e., scintillating), and even sometimes disappearing. ["Nova stella apparuit insolitae magnitudinis, aspectu fulgurans et oculos verberans non sine terrore. Quae mirum in modum aliquando contractior, aliquando diffusior, etiam extinguebatur interdum. Visa est autem per tres menses in intimis finibus Austri, ultra omnia signa quae videntur in coelo" (Hepidannus 1826, p. 81). Though one manuscript ascribes this event to the year 1012, the editor of this as well as other editions preferred the reading 1006.] If we assume that the observation was made at St. Gall, Switzerland (latitude $47\frac{1}{2}°$), and that the new star was in the vicinity of NGC 5882 (declination −41;28°) it would just have been visible above the south point on the horizon, in agreement with this report. The duration of visibility of three months agrees reasonably well with the other sources. A second Latin chronicle merely states that a very brilliant star shone forth in the year 1006 and that there was a great drought for three months. ["A. 1006 . . . clarissima stella effulsit et siccitas magna per tres menses fuit" (Annales Beneventani (1844, p. 177).]

3. FAR EASTERN ACCOUNTS

The Chinese and related Far Eastern records also mention a new star for the year 1006. Ho Peng Yoke (1962, p. 182) lists these records for the year 1006:

1965AJ.....70..105G

> 3rd April, 1006. "On an *i-ssu* day in the third month of the third year of the Ching-Te reign-period a 'guest star' [i.e., nova] was seen in the *SE*." [This Chinese record was already noted by Biot, (1843, p. 67). Cf. Hsi Tsē-tsung, (1958, p. 123), where a nova of 1006 near κ Lupi is listed on the basis of Chinese sources.] The Japanese records: "On the second day in the fourth month of the third year of the Kwanko reign-period [1 May 1006] a 'guest star' appeared at the south of the *Chhi-Kuan*. It was as bright as Mars and lasted the whole night." The Korean says: "During the ninth year of Mokchong a (*hui*) comet was observed."

Ho Peng Yoke comments: "It is difficult to say whether this Korean record was in any way connected with the Chinese 'guest star' of 3rd April of the same year." According to Star Map 3 (Ho Peng Yoke 1962, p. 217) the *Chhi-Kuan* is a group of stars including γ, δ, and β Lupi. NGC 5882 lies to the south of them and would seem to represent the right part of the sky. The Chinese record dates the appearance of this nova about one lunar month before the Japanese dating and the possibility of some textual corruption merits some investigation. The brightness of this nova, according to the Japanese, was equal to that of Mars, rather than brighter than Venus, and this may be the result of local weather conditions and its closeness to the horizon. Moreover, Mars, in Scorpio 18°, was the closest planet to the supernova, and it was perhaps natural to compare the supernova to it.

In sum, the general position of NGC 5882 is compatible with all of the medieval records of the supernova of 1006. The brightness of this supernova was only recorded for the time of its appearance, and it would seem that it remained essentially constant until shortly before its disappearance. Its duration of visibility was approximately $3\frac{1}{2}$ months, beginning about 1 May 1006.

Note added in proof. Since this paper was written, additional Far Eastern records have come to my attention. These records, according to the translations privately communicated to me, yield the following information:

1. The event of 3 April 1006 is unrelated to the supernova observed in May, in that the same source (*Sung Shih*) considers them independently;
2. The supernova was seen for several years (*Sung Shih*);
3. The supernova was seen about one degree to the west of β *Lupi* (*Sung Shih*), but a Japanese record (*Meigetsu-ki*) reports some people believed that the position of the supernova was identical with κ *Lupi*;
4. Its shape was like that of the half-moon; it was accompanied by rays; and it cast shadows (*Sung Shih*);
5. The color of the supernova was white-blue (*Ichidaiyôki*).

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APPENDIX I. ON THE SPURIOUS SUPERNOVA OF A.D. 827

My interest in this problem arose from a colloquium delivered to the Yale University Astronomy Department in the spring of 1964 by Dr. D. M. Dunlop, Professor of Arabic at Columbia University. He had been asked by A. G. W. Cameron and S. I. Rasool of the Goddard Institute for Space Studies to identify the ultimate source of a notice in an article of Knut Lundmark (1921, p. 236) concerning a suspected supernova [interest in this notice was stimulated by D. C. Morton (cf. his recent article, "Neutron Stars as X-Ray Sources," *Astrophys. J.*, **140**, 460, 1964. A similar notice is found in Hsi Tsê-tsung (1958, p. 120). Both of these notices claim to depend on Wolf, *Gesch. der Astron.* The proper reference, however, is to Wolf, 1872, p. 369]:

> A.D. 827. Under the government of the Kalif Al Mamum, the Arabian astronomers Haly and Giafar Ben Mohammed Albumazar found a very bright star whose light resembled in strength that of the Moon at quadrature. The star was situated in *Scorpio* and was observed for 4 months. The year but not the event is uncertain.

Dr. Dunlop proceeded to trace this reference to von Humboldt (1880, p. 212). It is interesting to note that on the same page von Humboldt refers to a supernova of 1006 which, as shown below, is identical to his supposed supernova of 827. Von Humboldt gives no reference for this supernova of 827, but Dr. Dunlop was able to find reference to it in Cassini (1740), who wrote

> Une quatrième [nouvelle étoile] qui fut apperçûe par Messahala Haly & Albumazar dans le neuvième siècle, au 15° degré du Scorpion, qui parut pendant l'escape de quatre mois entiers, & dont la clarté étoit si grande, qu'elle répandoit autant de lumière que la quatrième partie de le Lune.

The similarity of this notice to later ones make it reasonable to assume that it is their source. Messahala is to be identified with Masha'allah, an astrologer (d. 815) at the court of the khalif al-Ma'mūn. Haly is a corruption of the common Arabic name ‘Alī and cannot be immediately identified. Albumazar is to be identified with J*a*‘far b. Muḥammad Abu Ma‘shar, another astrologer at the court in Baghdad (d. 886). The reference to Masha'allah, if correct, already rules out the date, A.D. 827, for he had died more than ten years earlier. Though Cassini gives no reference for this notice, the previous paragraph concerning a new star of A.D. 389 gives a reference to Licetus, p. 259.

Dr. Dunlop then succeeded in tracing the passage in Cassini's treatise to two earlier published sources, *De Cometa* (Thomae Fieni, 1655, composed in 1619), *De Novis Astris et Cometis* (Fortunius Licetus Genuensis, Venice, 1623).

Licetus (1623) refers to this observation in two passages of his treatise:

> (1) *On the new heavenly body belonging to Scorpius.* According to the account of the College of Coimbra and the testimony of the very famous Thomas Fienus, among the astronomers of Arabia Messahala, Haly and Albumazar admit that they in their time saw a certain new star, above the orb of Venus, in the 15th degree of Scorpius, which was of so great brightness that it shed as much light over the whole of the horizon as a fourth part of the moon could shed, and it remained in the sky for four months. This judgment of the Arabs, that the new star lay above the orb of Venus, is approved by Cardanus, Tycho and other very famous mathematicians. (p. 259.)
>
> (2) *On the comet above the orb of Venus.* The well-known Jerome Cardanus, the College of Coimbra and Thomas Fienus unanimously affirm that among the Arabs who cultivated astronomy were Messahala, Haly and Albumazar, who in the year of the Lord 844 observed a comet above the orb of Venus that was certainly larger than Venus. The parallax of the comet was found to be perceptable. Parallax was determined by those astronomers with a most accurate ruler which indicated the altitude of stars. (p. 269.)

In one passage Licetus has referred to the object as a new star while in the other he has taken it to be a comet. The parallax instrument mentioned at the end of the second passage is presumably identical with the instrument described by Ptolemy (*Almagest*, Vol. V, p. 12). Not knowing the proper motion of the comet, they could not, of course, determine its parallax. Licetus has added a *post hoc* argument in deciding that this celestial body was a comet. He may well have been influenced by the following passage of Abu Ma‘shar (Thorndike 1954)

> Said Albumasar, 'The philosophers say, and Aristotle himself, that comets are in the sky in the sphere of fire, and that nothing of them is formed in the heavens, and that the heavens undergo no alteration. But they all have erred in this opinion. For I saw with my own eyes a comet beyond Venus, because its color was not affected. And many have told me that they have seen a comet beyond Jupiter and sometimes beyond Saturn.'

It is noteworthy that Abu Ma‘shar decided upon the distance of the comet without any reference to parallax. This passage of Abu Ma‘shar can be traced in the works of Cardanus [*Aphorismorum Astronomicorum Segmenta VII*, *Opusculum incomparibile*, appended to the edition of 1547 *Hieronymi Cardani Libelli V*, p. 217, as noted by Hartner (1960, p. 144)] and Tycho Brahe [(1916, pp. 111, 296.) "Id solummodo, quod in fine sui Scripti ex Aphorismo quodam Cardani (qui sic habet) citat: *Dixit Albumasar, Cometa supra Venerem visus fuit; non igitur in Elementari Regione est, contra Philosophum.*" (p. 296.)]

Fienus mentioned this event in two passages:

> (1) Besides those already mentioned, there were, among the Arabs, Messahala, Haly, and Albumazar, who according to the Quadripartitum, (book) II, of Ptolemy, observed, in the year of our Lord 844, a comet above the orb of Venus . . . (p. 9.)
>
> (2) Haly wrote in his Commentary on Ptolemy, Quadripartitum II, 9, of the appearance of a temporary new star in the 15th degree of Scorpio above the orb of Venus, which was itself seen by other men of knowledge, and which was so bright that it shed light on the horizon, as much light as would be shed by a quarter part of the moon, and which remained in the sky for four months. (p. 21.)

Note again that "above the orb of Venus" means that the object seen was assumed to lie further away from the earth than the sphere of Venus. The first passage indicates the year 844 rather than 827, which we have seen in later notices, and again lists the same astrologers as the observers of this event. The second passage clearly indicates that his source was a passage in a commentary to *The Quadripartitum* of Ptolemy.

This completes the sources identified by Dr. Dunlop at the astronomy colloquium at Yale University, spring 1964. A few days later I was asked by Dr. Cameron to pursue the search for the ultimate source of this notice as well as for other possible references to a supernova.

The proper identification of Haly may be ascertained from the passage in Fienus or from a notice of Cardanus [1555, p. 353 ff.]. Haly is none other than 'Alī b. Riḍwān (d. 1061) who wrote a commentary in Arabic to Ptolemy's *Tetrabiblos* (Latin: *Quadripartitum*). Thus the passage on which this entire tradition is based refers to an event of the eleventh century rather than the ninth century.

(*Appendix II follows on next page.*)

1965AJ.....70..105G

APPENDIX II. ARABIC TEXTS

Manuscript variants on a single word have been footnoted. Text 1. ‘Alī b. Riḍwān.

وانا ارسم لك فى هذا الموضع اثرا شاهدته فى مبدا تعليمى ظهر هذا الاثر فى برج العقرب على مقابلة الشمس وكانت الشمس يوميذ فى خمس عشرة درجة من الثور والنيزک فى يه درجة من العقرب وكان نيزكا عظيما مستدير الشكل يكون عظمه قدر الزهرة مرتين ونصف او ثلاث مرات وكان نوره يضىء منه الافق ويلمع لمعانا شديدا ومقدار ضيائه ربع ضياء القمر واكثر قليلا ولم يزل ظاهرا ويتحرك فى برجه بحركة معدل النهار الى ان صارت الشمس الى تسديسه من برج السنبلة فبطل دفعة واحدة وجميع ما ذكرته من امره هو مشاهده وقد رصده من كان ايضا فى زمانى من العلماء فكان على ما ذكرته سوا ومواضع الكواكب فى وقت مبدا ظهوره على هذه الصفة. الشمس والقمر يجتمعان فى برج الثور يه درجة زحل بالاسد يب درجة وبا دقيقة المشترى فى السرطان يا درجة وكا دقيقة المريخ بالعقرب كا وبط الزهرة بالجوزاء يب كح

عطارد بالثور ه يا الجوزهر بالقوس كج لح النيزك الذى
حدث بالعقرب يه درجة وطالع الاجتماع الذى كان فيه
فى وقت ظهور هذا النيزك على فسطاط مصر الاسد د ب
وعاشرة الثور بالحمل كو كز فلان العقرب برج كسوف ملة
الاسلام وقد انها حدث بالمسلمين بعضهم فى بعض حروب
عظيمة وحربت لهم بلدان عظيمة وخرج على ملك الحرمين
خارجى عظيم ووقع القحط والغلاء والوباء ومات بالسيف
والغلاء والوباء خلق لا يحصى عددهم والوف كثيرة جدا
وكان ذلك فى وقت ظهور النيزك واتصل البلاء والفساد بعد
ظهوره سنين كثيرة ونحن نستقصى ذلك فى المثالات [ل] .

[ل] المثلثات .

Text 2. Ibn al-Athīr: Events of A.H. 396.

وفيها مستهل شعبان طلع كوكب كبير تشبه الزهرة عن
يسرة قبله العراق له شعاع على ارض كشعاع القمر وبقى
الى منتصف ذى القعدة وغاب .

1965AJ.....70..105G

Text 3. Ibn al-Jawzī: Events of A.H. 936.

سنة ٣٩٦ . فمن الحوادث فيها انه طلع كوكب كبير يشبه الزهرة فى كبره واضاءته عن يسرة القبلة يتموج وله شعاع على الارض كشعاع القمر وذلك فى ليلة الجمعة مستهل شعبان وثبت الى النصف من ذى القعدة ثم غاب .

Text 4. *Annales Regum Mauritaniae.* A variant text adds the passages in parentheses.

وفى سنة اربع وتسعين وثلاث مائة طلع الكوكب الوقاد فى السماء وكان نجما عظيم الجرم كثير الضياء .(يطلع فى افق الشرق فقال بعض المنجمين ان ذلك النجم يعرف بالمضى ذى اذناب وهو نجم عظيم المنظر مفرط الضياء شديد الاضطراب والحركة له ذوايب اربعة مجردة الاطراف).

وفى سنة ست وتسعين وثلاث مائة طلع نجم عظيم[1] من ذوات الذوانب شديد الارتعاد[2] (والحركة يكاد احظ متأمل يستقر فيه) وهو احد النيزك الاثنى ذكرها الاوايل ورصدها علماؤهم فى مدة طويلة وزعموا انه لا يظهر منها كوكب الا لقضية يحدثها الله تعالى فى العالم والله اعلم بغيبه (وكان ابتدا ظهوره فى اول شعبان من سنة ست وتسعين المذكورة طلع اول ظهوره قبل وقت المغرب ثم تقهقر الى ان طلع فى الليل واقام مدة من ست اشهر ثم غاب وكان بهذه سنة رياح كثيرة وبروق خاطفة ورعد قاصفة دون مطر).

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[1] غريب.

[2] الاتقاد.